Exploring NOVA:

Conceptualizing an AI Co-Investigator for Introductory Physics Labs

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The Problems in Physics Labs

Educators: Limited time and support

Instructors often juggle large classes with minimal resources

Difficult to offer real-time help to every student during labs

Tools: Technical barriers

Students struggle with tools like Excel, Google Sheets, or python programming

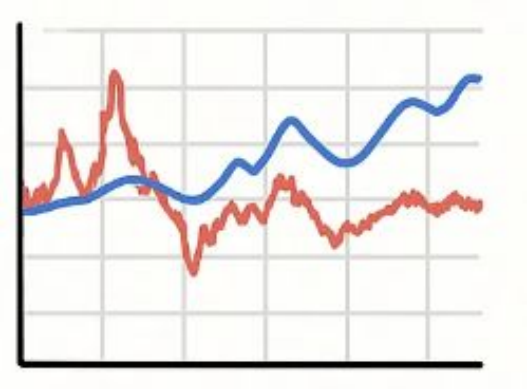
Basic tasks become overwhelming

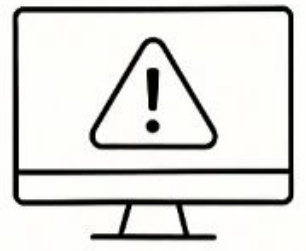
Students: Lack of interest and understanding

Many students enter labs unsure how the experiment connects to the physics concepts

Confusion leads to disengagement

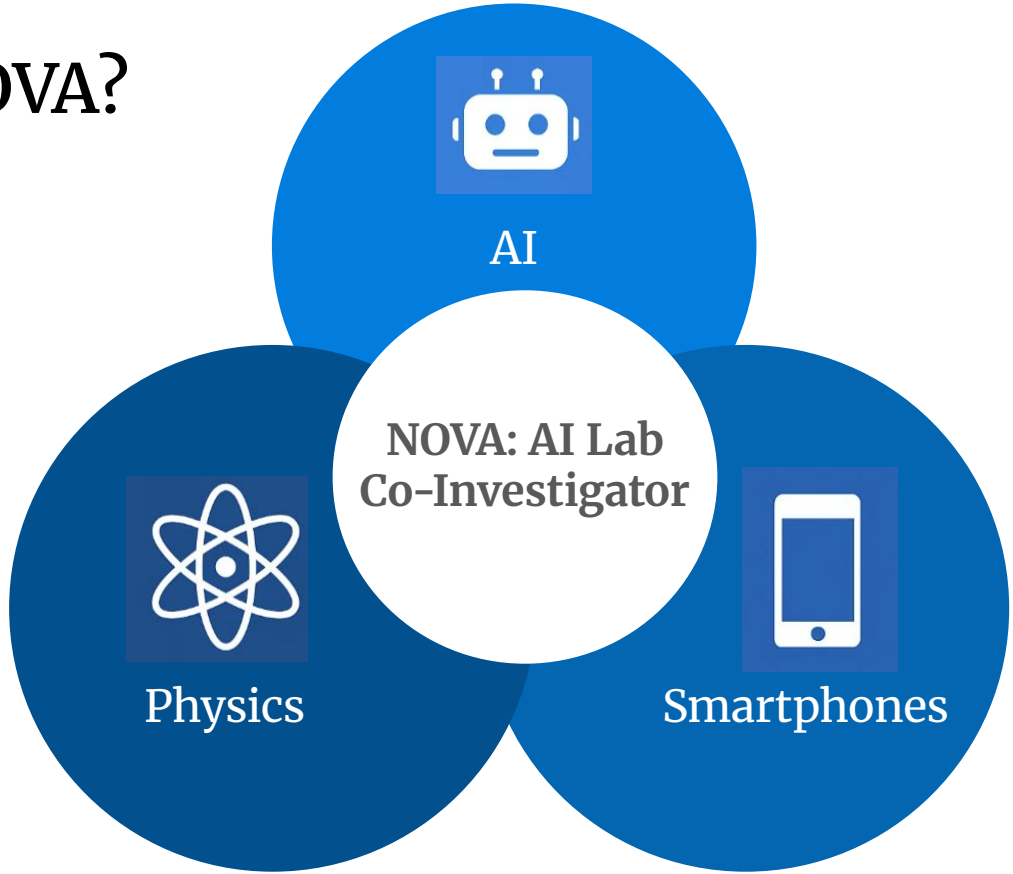
Getting Started: AI Deep Dive





- Designed a series of prompts to see how well AI could:
  - Explain concepts
  - Perform calculations
  - Create and interpret graphs
  - Identify experimental errors and explain physical basis
- AI is powerful, but prompt-dependent

What is NOVA?



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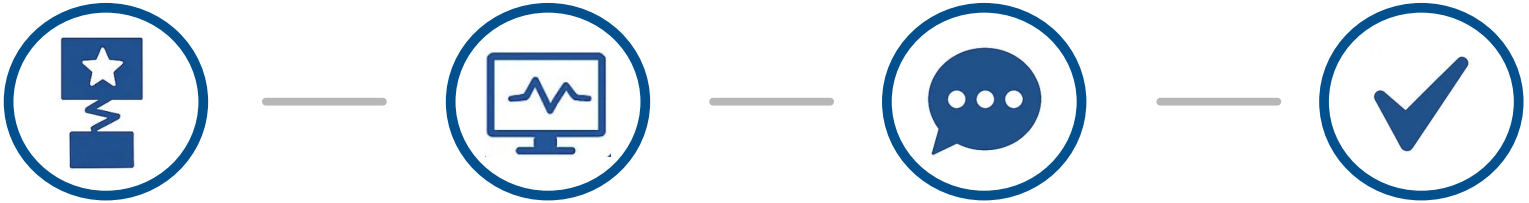
Example Workflow



Start an Experiment

User selects a topic or specific lab from the library

Live Data Collection

Graphs generate in real time using smartphone sensors

Chat-Based Interpretation

Asks guiding questions like “What do you notice about this slope?”

Users could click on graph points to ask for more insight or clarification

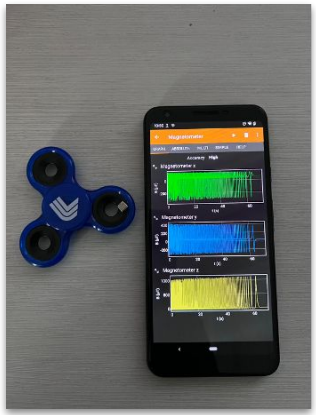
Feedback and Reflection

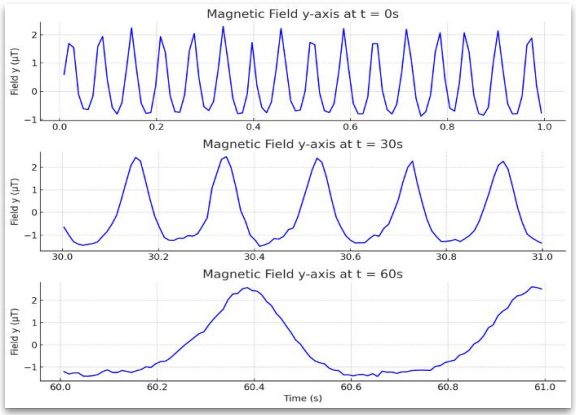
AI offers troubleshooting tips and helps interpret results

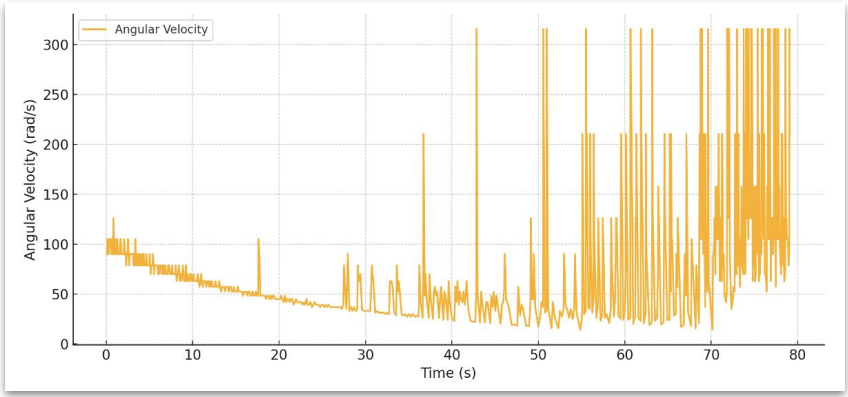
Notes and data could be saved to a personal notebook for later review

Spinning Smarter

- Students used the phyphox app to record magnetic field data over time
- The data showed a decaying oscillating signal
  - Longer periods







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Data Analysis

Initial Analysis

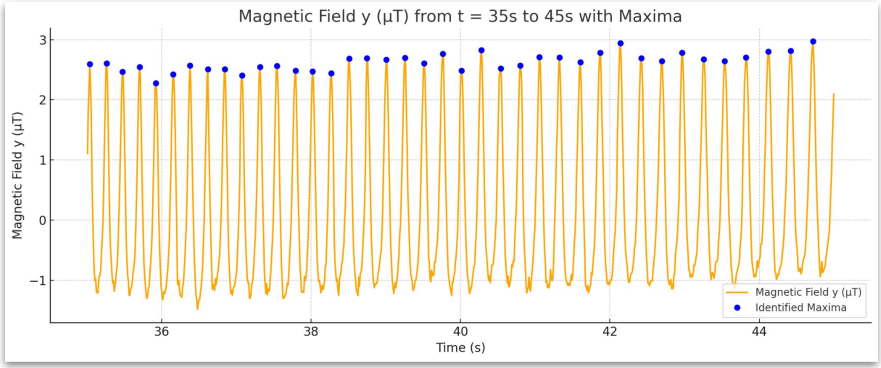
➔ Visualize one-second zoom-ins at different time points

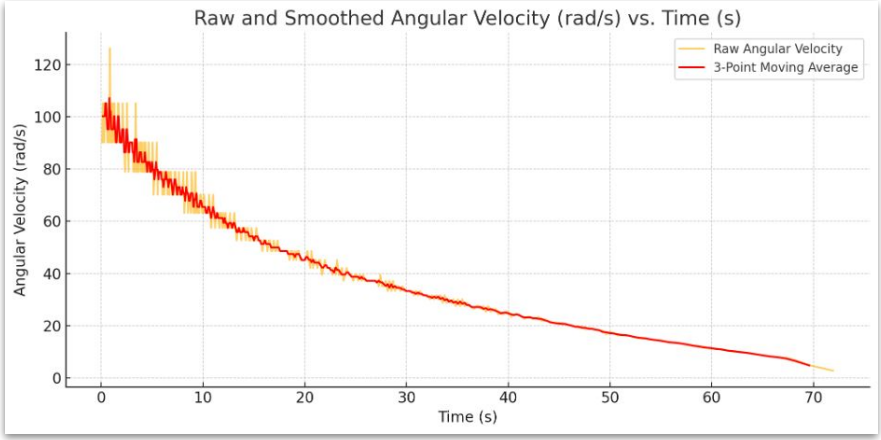
Peak Detection

➔ Identify maxima to calculate angular velocity, but did not accurately determine maxima correctly

Iterative Refinement

➔ Students improved their prompts with new constraints





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STEM with Phones

- Students were able to offload tedious calculations and focus on conceptual thinking
- Prompt clarity had a major effect on AI performance
- Every student's data looked different
  - AI needed adaptable logic

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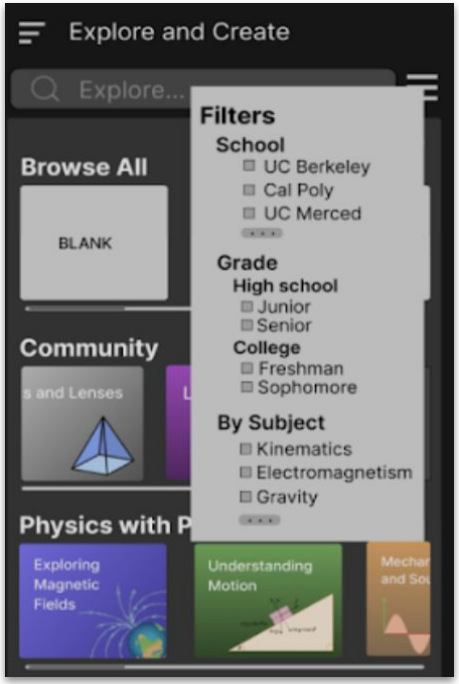
What's Next for NOVA?

Physics Toolbox
Vieyra Software

ChatGPT

phyphox
physical phone experiments

NOVA
AI LAB CO-INVESTIGATOR



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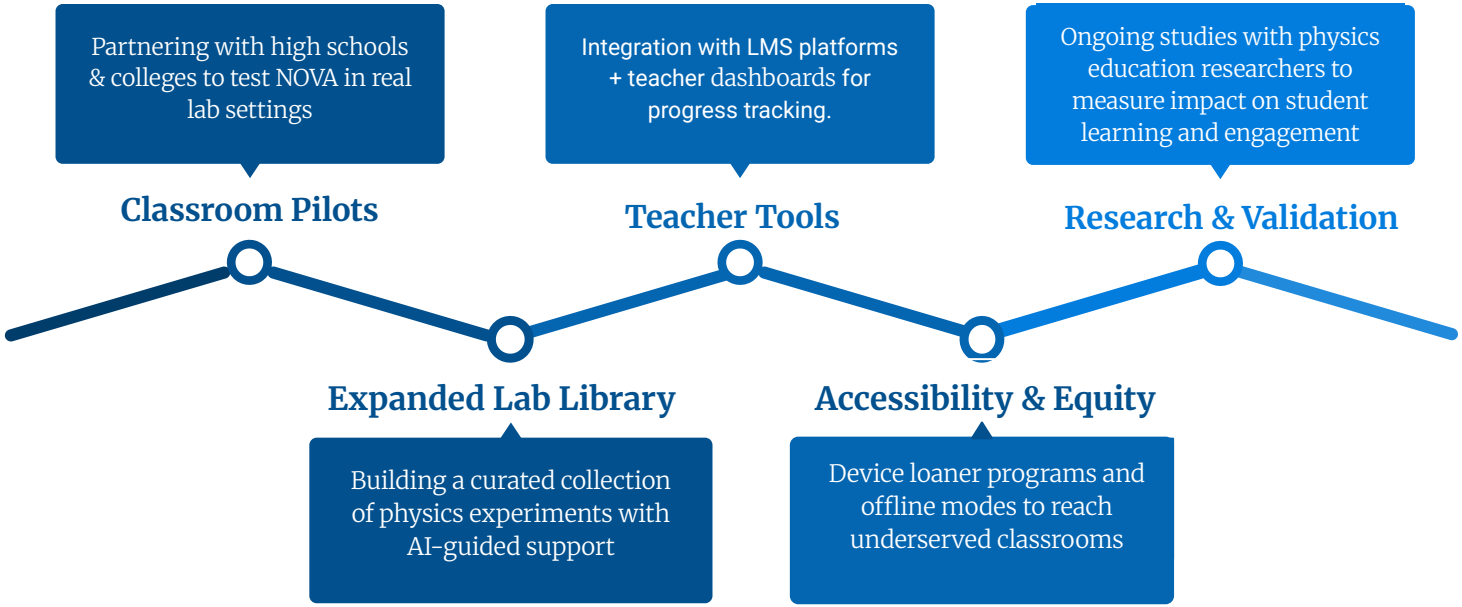
Long-Term Vision for NOVA



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Thank you!

- NOVA supports equity, curiosity, deeper learning
- Thanks to